WHAT IS CLAIMED IS:

1. A method for plating a film to a desired thickness on a surface of a substrate, comprising:

plating the film to the desired thickness on a first portion of the substrate surface; and

plating the film to the desired thickness on at least a second portion of the substrate surface to give a continuous film at the desired thickness on the substrate.

2. The method of claim 1 in which the desired thickness is for a continuous seed layer of the film on the substrate.

3. The method of claim 2, further comprising the step of:

plating an additional thickness on the continuous seed layer to give a continuous film of a second uniform thickness greater than the desired thickness of the seed layer on the substrate.

4. The method of claim 3 in which the film is plated on the first portion of the substrate by flowing an electrolyte on the first portion of the substrate surface and applying a plating current to plate the film on the first portion of the substrate until the film reaches the desired thickness; repeating the electrolyte flowing and plating current flowing steps for at least the second portion of the substrate to plate the film on the second portion to the desired thickness; and flowing electrolyte to the first portion and at least the second portion of the substrate and applying plating current to at least the second portion until the second uniform thickness is obtained.

5. The method of claim 4 in which the film is plated on the first and second portions of the substrate by independently providing plating current to plating electrodes for the first and second portions.

6. The method of claim 5 in which the electrolyte is indepently flowed to the first and second portions of the substrate.

7. The method of claim 1 in which the film is plated on the first and the second portion of the substrate by flowing electrolyte on the first and the second portion of the substrate at the same time, and applying plating current to plating electrodes for the first and second portions separately.

8. The method of claim 7 additionally comprising the step of providing a sufficient current to the first portion of the substrate to prevent deplating after the film reaches the desired thickness on the first portion of the substrate while applying the plating current to the second portion of the substrate.

9. The method of claim 7 additionally comprising the step of providing a sufficient plating voltage to the second portion of the substrate to prevent deplating while applying the plating current to the first portion of the substrate.

10. The method of claim 7 additionally comprising the step of moving the first portion of the substrate out of the electrolyte after the film reaches the desired thickness on the first portion of the substrate while applying the plating current to the second portion of substrate.

11. The method of claim 1 in which the film is plated on the first and the second portion of the substrate by flowing electrolyte on the first portion of the substrate while plating the film on the first portion of the substrate, and by flowing electrolyte to the first and second portion of the substrate at the same time while plating the film on the second portion of the substrate.

12. The method of claim 11 additionally comprising the step of providing a sufficient plating voltage to the first portion of the substrate to prevent deplating after the film reaches the desired thickness on the first portion of the substrate while applying the plating current to the second portion of substrate.

13. The method of claim 1 in which the film is plated on the first and the second portion of the substrate by only flowing electrolyte on the first portion of the substrate through moving a movable jet anode close to the first portion of substrate; and by only flowing electrolyte on the second portion of the substrate through moving a movable jet anode close to the second portion of the substrate.

14. The method of claim 1 additionally comprising the step of immersing the substrate surface into electrolyte, and the film is plated in the first and the second portion of the substrate by separately moving a movable jet anode close to the first portion of substrate and moving a movable jet anode close to the second portion of the substrate.

15. The method of claim 1 in which the film continues to be plated on the first portion of the substrate while the film is plated on the second portion of the substrate.

16. The method of claim 15 in which the film is plated on the first and the second portion of the substrate by flowing electrolyte on the first portion of the substrate while plating the film on the first portion of the substrate, and by flowing electrolyte to the first and second portions of the substrate at the same time while plating the film on the first and the second portion of the substrate simultaneously.

17. The method of claim 16 in which the film is plated on the first and second portions of the substrate to the desired thickness to give a continuous seed layer, further compring the step of:
plating an additional thickness on the continuous seed layer to give a continuous film of a second uniform thickness greater than the desired thickness of the seed layer on the substrate.

18. The method of claim 1 in which the film is plated on the first and the second portion of the substrate by flowing electrolyte only on the first portion of the substrate while plating the film on the first portion of the substrate, and by flowing electrolyte to the first and second portion of the substrate at the same time while plating the film on the second portion of the substrate.

19. The method of claim 18 additionally comprising the step of providing a sufficient plating voltage to the first portion of the substrate to prevent deplating after the film reaches the desired thickness on the first portion of the substrate while applying the plating current to the second portion of substrate.

20. The method of claim 19 in which the film is plated on the first and second portions of the substrate to the desired thickness to give a continuous seed layer, further comprising the step of:
plating an additional thickness on the continuous seed layer to give a continuous film of a second uniform thickness grater than the desired thickness of the seed layer on the substrate.

21. The method of claim 1 in which the second portion of substrate is adjacent to the first portion of substrate.

22. The method of claim 1 in which the substrate is a semiconductor wafer.

23. The method of claim 22 in which the semiconductor wafer is a silicon wafer.

24. The method of claim 23 in which the silicon wafer includes a barrier layer on its top.

25. The method of claim 24 in which the barrier layer is titanium, titanium nitride, tantalum or tantalum nitride.

26. The method of claim 24 in which the semiconductor wafer further includes a seed layer on top of the barrier layer.

27. The method of claim 26 in which the seed layer is thicker proximate to a peripheral area and thinner on an inner area of the semiconductor wafer.

28. The method of claim 22 in which the film comprises interconnects in integrated circuits on the semiconductor wafer.

29. The method of claim 28 in which the interconnects are in a damascene structure.

30. An apparatus for plating a film on a substrate, comprising:
a substrate holder for positioning the substrate for contact with a plating electrolyte;
at least one anode for supplying plating current to the substrate;
at least two flow controllers connected to supply electrolyte contacting the substrate;
a control system coupled to said at least one anode and said at least two flow controllers to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

31. The apparatus of claim 30 in which said at least one anode comprises at least two anodes separated by an insulating wall enclosing each of the at least two anodes.

32. The apparatus of claim 31 in which the insulating wall of each anode is of the same height.

33. The apparatus of claim 31 in which the insulating wall of each anode is of a different height.

34. The apparatus of claim 31 in which the insulating wall of each anode proximate to a center of the substrate are higher than the insulating wall of each anode proximate to an edge of said substrate.

35. The apparatus of claim 31 in which the insulating wall of each anode proximate to a center of the substrate are lower than the insulating wall of each anode proximate to an edge of said substrate.

36. The apparatus of claim 31 in which the at least two flow controllers are separate valves for selectively supplying plating electrolyte to the portions of the substrate adjacent each of the at least two anodes, the apparatus additionally comprising at least one pump coupled to the separate valves.

37. The apparatus of claim 36 in which the at least one pump comprises two pumps.

38. The apparatus of claim 36 additionally comprising a pressure leak valve coupled to an outlet of the at least one pump.

39. The apparatus of claim 36 in which the valves are liquid mass flow control valves.

40. The apparatus of claim 31 in which the at least one control system is configured to selectively supply plating current to said at least two anodes.

41. The apparatus of claim 31 additionally comprising a plurality of electrolyte flow channels configured to supply the electrolyte to the successive portions of the substrate.

42. The apparatus of claim 41 in which each of said plurality of electrolyte flow channels has an inlet and a plurality of nozzles facing said substrate holder.

43. The apparatus of claim 41 in which two adjacent electrolyte flow channels comprises at least one electrolyte return path between the two adjacent electrolyte flow channels.

44. The apparatus of claim 30 in which said substrate holder is movable up and down for adjusting a gap between said substrate and said anode.

45. The apparatus of claim 30 in which said substrate holder is oscillatable in a horizontal direction during plating.

46. The apparatus of claim 30 in which said substrate holder is rotatable around an axis vertical to substrate during the plating process.

47. The apparatus of claim 30 further comprising a temperature control device to maintain said electrolyte at a constant temperature during the plating process.

48. The apparatus of claim 30 further comprising a tank and a filter coupled to said at least two flow controllers for circulating electrolyte during the plating process.

49. The apparatus of claim 30 in which said control system comprises at least two DC power supplies operable in constant current mode.

50. The apparatus of claim 30 in which said control system comprises at least two DC power supplies operable in constant voltage mode.

51. The apparatus of claim 50 in which the at least two DC power supplies operable in both a constant voltage mode and a constant current mode.

52. The apparatus of claim 30 in which said control system comprises at least two pulse power supplies.

53. The apparatus of claim 52 in which the at least two pulse power supplies are operable in a bipolar pulse, modified sine-wave, unipolar pulse, pulse reverse, pulse-on-pulse or duplex pulse mode.

54. The apparatus of claim 52 in which said at least two pulse power supplies is operable in a phase shift mode.

55. The apparatus of claim 30 in which said control system comprises at least one charge monitor to measure thickness of film being plated.

56. The apparatus of claim 55 in which said control system includes software to control thickness uniformity of film being plated on the substrate based on thickness input from the at least one charge monitor.

57. The apparatus of claim 30 in which said at least one anode has a circular, elliptical or polygonal shape.

58. The apparatus of claim 57 in which the polygonal shape is a triangle, square, rectangle or pentagon.

59. The apparatus of claim 57 in which said anode comprises at least two sub-anodes positioned to form the circular, elliptical or polygonal shape.

60. The apparatus of claim 59 in which the sub-anodes are electrically isolated from each other.

61. The apparatus of claim 30 in which said control system further includes a logic table to check continuity of the film after successive plating of the film on the portions of the substrate.

62. The apparatus of claim 30 additionally comprising a plurality of electrolyte flow channels and in which said at least two flow controllers each comprise a valve and an outlet from one of said plurality of electrolyte flow channels.

63. The apparatus of claim 62 in which each valve and outlet is radially positioned relative to a center of the substrate.

64. The apparatus of claim 62 in which said plurality of flow controllers each further comprises a liquid mass flow controller and a pump, and said control system is configured to turn off the valve of one of the flow controllers while plating film on the portion of said substrate above the outlet of the flow channel controlled by the one of the flow controllers.

65. The apparatus of claim 62 in which said at least one anode is a single electrode.

66. The apparatus of claim 62 in which said at least one anode comprises at least two electrically connected electrodes connected electrically, each of the electrodes being in a different one of the plurality of electrolyte flow channels.

67. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate for contact with a plating electrolyte;

at least two anodes for supplying plating current to the substrate;

at least one flow controller for controlling electrolyte contacting the substrate;

at least one control system coupled to said at least one anode and said at least one flow controller to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

68. The apparatus of claim 67 in which said at least two anodes are separated by an insulating wall enclosing each of the at least two anodes.

69. The apparatus of claim 67 in which the at least one control system is configured to selectively supply plating current to said at least two anodes.

70. The apparatus of claim 67 additionally comprising a plurality of electrolyte flow channels configured to supply the electrolyte to the successive portions of the substrate.

71. The apparatus of claim 70 in which each of said plurality of electrolyte flow channels has a plurality of nozzles facing said substrate holder.

72. The apparatus of claim 67 in which the at least one flow controller is at least one mass flow controller.

73. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate for contact with a plating electrolyte;

at least one anode for supplying plating current to the substrate;

at least one flow controller for controlling electrolyte contacting the substrate said at least one flow controller comprising at least three cylindrical walls, a first of the cylindrical walls positioned under a center portion of the substrate extending upward closer to the substrate than a second one of the cylindrical walls positioned under a second portion of the substrate peripheral to the center portion;

a drive mechanism coupled to said substrate holder to drive said substrate holder up and down to control one or more portions of the substrate contacting the electrolyte;

at least one control system coupled to said at least one anode and said at least one flow controller to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

74. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate for contact with a plating electrolyte;

at least one anode for supplying plating current to the substrate;

a flow controller for controlling electrolyte contacting the substrate, said at least one flow controller comprising at least three cylindrical walls movable upward toward the substrate and downward away from the substrate, to adjust a gap between the substrate and each of the cylindrical walls to control one or more portions of the substrate contacting the electrolyte;

at least one control system coupled to said at least one anode and said flow controller to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

75. The apparatus of claim 74 in which said at least one anode comprises at least two anodes.

76. The apparatus of claim 75 in which said flow controller additionally comprises at least two valves for controlling flow of electrolyte to different portions of the substrate.

77. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate above an electrolyte surface;

at least one movable jet anode for supplying plating current and electrolyte to the substrate, said movable jet anode being movable in a direction parallel to the substrate surface;

at least one flow controller for controlling electrolyte flowing through said movable jet anode;

at least one control system coupled to said movable jet anode and said flow controller to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

78. The apparatus of claim 77 in which said substrate holder is rotatable around an axis perpendicular to the substrate.

79. The apparatus of claim 77 in which said substrate holder is movable into the electrolyte to immerse the substrate completely into the electrolyte and movable away from the electrolyte.

80. The apparatus of claim 77 in which said moveable jet anode comprises one anode and an electrolyte flow nozzle enclosing the anode.

81. The apparatus of claim 80 in which said movable jet anode further comprises a second electrode outside of and positioned around the nozzle.

82. The apparatus of claim 81 in which said movable jet anode further comprises an insulating wall positioned around the second electrode, and a third electrode positioned around the insulating wall.

83. The apparatus of claim 77 in which said movable jet anode is movable in a straight path parallel to the substrate.

84. The apparatus of claim 77 in which said movable jet anode is movable in a curved path parallel to the substrate.

85. The apparatus of claim 84 in which the curved path is a spiral path.

86. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate in a body of electrolyte;

at least one movable jet anode for supplying plating current and electrolyte to the substrate, said movable jet anode being movable in a direction parallel to the substrate surface;

a flow controller for controlling electrolyte flowing through said movable jet anode;

at least one control system coupled to said movable jet anode and said flow controller to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

87. The apparatus of claim 86 in which said movable jet anode is movable in a straight path parallel to the substrate.

88. The apparatus of claim 86 in which said movable jet anode is movable in a curved path parallel to the substrate.

89. The apparatus of claim 88 in which the curved path is a spiral path.

90. The apparatus of claim 86 in which the substrate is positioned horizontally, adjacent to and under said movable jet anode.

91. The apparatus of claim 86 in which the substrate is placed vertically adjacent to said movable jet anode.

92. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate above an electrolyte surface;

a first drive mechanism coupled to said substrate holder to move said substrate holder toward and away from the electrolyte surface to control a portion of a surface of the substrate contacting the electrolyte;

a bath for the electrolyte;

at least one anode mounted in said bath;

a second drive mechanism coupled to said bath to rotate said bath around a vertical axis to form a substantially parabolic shape of the electrolyte surface;

a control system coupled to said first and second drive mechanisms and to said at least one anode to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

93. The apparatus of claim 92 further comprising at least one flow controller to supply fresh electrolyte during plating.

94. The apparatus of claim 92 in which said at least one anode comprises a plurality of anodes.

95. The apparatus of claim 92 further comprising a third drive mechanism coupled to said substrate holder to rotate said substrate holder around an axis vertical to the surface of the substrate.

96. An apparatus for plating a film on a substrate, comprising:

a substrate holder for positioning the substrate above an electrolyte surface;

a first drive mechanism coupled to said substrate holder to move said substrate holder toward and away from the electrolyte surface to control a portion of a surface of the substrate contacting the electrolyte;

a second drive mechanism coupled to said substrate holder to rotate said substrate holder around an axis vertical to the surface of the substrate;

a third drive mechanism coupled to said substrate holder to tilt said substrate holder with respect to the electrolyte surface;

a bath for the electrolyte;

at least one anode mounted in said bath;

a control system coupled to said first, second and third drive mechanisms and to said at least one anode to provide electrolyte and plating current in combination to successive portions of the substrate to provide a continuous, uniform thickness film on the substrate by successive plating of the film on the portions of the substrate.

97. The apparatus of claim 96 further comprising at least one flow controller to supply fresh electrolyte during plating.

98. The apparatus of claim 96 in which said at least one anode comprises a plurality of anodes.

99. The apparatus of claim 96 in which the third drive mechanism is configured to tilt the substrate holder in a tilting angle from about 0 to 180 degrees.

100. The apparatus of claim 96 additionally comprising:

a fourth drive mechanism coupled to said bath to rotate said bath around a vertical axis to form a substantially parabolic shape of the electrolyte surface.

101. A method for plating a film to a desired thickness on a surface of a substrate, comprising:

providing a plurality of stacked plating modules and a substrate transferring mechanism;

picking up a substrate from a substrate holder with the substrate transferring mechanism;

loading the substrate into a first one of stacked plating modules with the substrate transferring mechanism;

plating a film on the substrate in the first the one of the stacked plating modules;

returning the substrate to said substrate holder with the substrate transferring mechanism.

102. The method of claim 101, further comprising the step of:

after plating the film on the substrate, drying the substrate by at least one of spinning the substrate or directing drying gas onto the substrate.

103. The method of claim 101 in which at least a second one of the plurality of plating modules is a cleaning module, further comprising the steps of:

after plating, picking up the substrate with the substrate transferring mechanism from the first one of the stacked plating modules;

placing the substrate into the second one of stacked plating modules for cleaning;

cleaning the substrate in the second one of the stacked plating modules; and

drying the substrate in the second one of the stacked plating modules.

104. An automated tool for plating a film on a substrate, comprising:

at least two plating baths positioned in a stacked relationship;

at least one substrate holder;

a substrate transferring mechanism;

a frame supporting said plating baths, said substrate holder and said substrate transferring mechanism; and

a control system coupled to said substrate transferring mechanism, substrate holder and said plating baths to continuously perform uniform film deposition on a plurality of the substrates.

105. The automated tool of claim 104 further comprising:

at least two cleaning modules positioned in a stacked relationship with said at least two plating baths.

106. The automated tool of claim 104 in which the substrate transferring mechanism includes a telescoping member movable in x, y and z axes.

107. The automated tool of claim 104 in which said substrate transferring mechanism is mounted on a bottom portion of said frame.

108. The automated tool of claim 104 in which said substrate transferring mechanism is mounted on a top portion of said frame.

109. The automated tool of claim 104 further comprising at least a second set of plating baths positioned in a stacked relationship and at least two additional cleaning modules positioned in a stacked relationship with said second set of plating baths.

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